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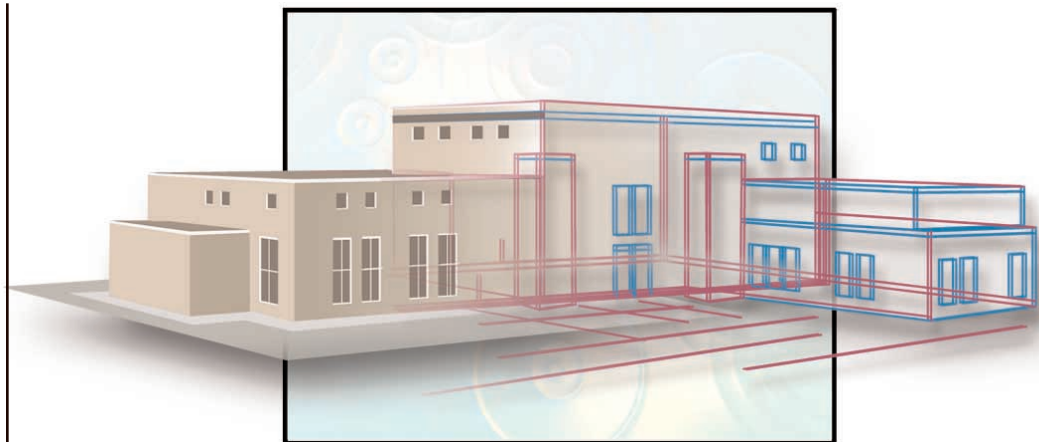
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Subsurface Geosciences Laboratory Conceptual Design Contract Awarded

The conceptual design contract for the Subsurface Geosciences Laboratory, a unique, state-of-the-art geosciences research facility to be located at the U.S. Department of Energy's Idaho National Engineering and Environmental Laboratory (INEEL), was recently awarded to Zimmer-Gunsul-Frasca Partnership (ZGF) of Portland, OR.

The conceptual design for the new Subsurface Geosciences Laboratory (SGL) is just the first step in a multi-step process to construct a new facility by 2007. Each step—from conceptual design to engineering design to actual construction—will require approval by the U.S. Department of Energy (DOE), extensive scientific peer review, and most important, funding appropriation by Congress.

"This may seem like a long and arduous process, but the end result—a new, national user facility at the INEEL furnished with unique equipment and experimental capabilities—will be worth the effort," said Ray Stults, INEEL Associate Laboratory Director. "It will give us new capabilities to solve complex environmental problems, will attract visiting scientists from around the world to collaborate with staff at the INEEL, and establish the INEEL as an international center for subsurface science research."

Zimmer-Gunsul-Frasca Partnership Noted for Award-Winning Designs

An experienced team was assembled by ZGF, an award-winning 50-year-old firm that specializes in laboratory design. "We are very excited to be working with the DOE again on its environmental cleanup mission, which is so important to our region and country," said Bob Frasca, a design partner on the project who worked previously with DOE in Richland, Washington. The project team met at the INEEL on July 12, 2001 for the kickoff and is expected to complete the conceptual design of the facility by Jan. 14, 2002.

(Conceptual Design Contract, continued on page 2)

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For more information about
INEEL's Subsurface Science
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<http://subsurface.inel.gov/>
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SubsurfaceTopics provides technical
partners and interested researchers
with information and updates
about the INEEL's Subsurface
Science Initiative and related
research.



Building a Federally-Funded Laboratory

When it comes to building a state-of-the-art research facility with an estimated cost of \$150 million, every decision is carefully evaluated. INEEL's Subsurface Geosciences Laboratory (SGL) will be one of the first DOE construction projects to undergo a new, rigorous project planning, reporting, and review and approval process. The process began for the SGL on November 17, 2000 when the Assistant Secretary of Energy for DOE's Office of Environmental Management signed an Action Memorandum giving the INEEL approval to begin Conceptual Design.

The Conceptual Design phase ends when the conceptual design is delivered to the Energy Systems Acquisition Advisory Board (ESAAB) for approval. This approval, known as Critical Decision 1, is scheduled for June 2002. Following approval, the next phase begins.

The Preliminary Design phase involves the development of detailed engineering plans—projected cost, scope, and schedule for construction—to support the planned research activities and ensure compliance with environmental, safety and health requirements. By late 2003, the INEEL hopes to have approval (Critical Decision 2) for this step.

The Final Design phase, the development of refined and detailed design, then begins. Its completion ultimately leads to authorization of construction (Critical Decision 3), tentatively scheduled for the spring of 2005.

INEEL can then begin physical construction. This phase includes preparing and excavating the site and initiating procurements with long lead-times, such as those for materials and equipment.

When construction is completed, the new facility will be tested and turned over for operations via a formal authorization (Critical Decision 4) to occupy and operate the facility. This final step is scheduled for early 2007.

(Conceptual Design Contract, continued from page 1)

ZGF's team is composed of firms with expertise in laboratory design and previous experience in working with DOE. Earl Walls Associates will lead laboratory programming, planning and design; Ove Arup will lead mechanical, electrical, and structural engineering design (including plans for specialized vibration-insulated laboratory space, audio visual, communications and acoustical facility components); CH2M Hill will lead civil engineering design; Rolf Jensen & Associates will lead life-safety code design compliance; and Davis Langdon Adamson will lead project cost estimating.

Designing a Friendly Environment for Sophisticated Mesoscale Research

In their technical proposal, ZGF acknowledged the technical complexity of designing a mesoscale research complex, but also stressed the importance of the

INEEL's SGL Provided with Unique Equipment and Capabilities

The INEEL's plan for the new Subsurface Geosciences Laboratory (SGL) is to build an approximately 200,000-square-foot research laboratory in Idaho Falls designed to advance geoscience research. The unique equipment and capabilities planned for the SGL will give researchers new tools to better understand how contaminants interact with their surroundings, change over time, and move through soil and groundwater. The INEEL will use this knowledge to develop more accurate predictive models and more effective approaches to environmental remediation.

Distinguished by Mesoscale Research

The distinguishing attribute of the SGL is a focus on mesoscale research, experiments that are often significantly larger than those performed in traditional laboratories and designed to mimic complex, real-world processes. Researchers are currently developing experimental plans for above-ground tanks with dimensions up to 60 feet long and 30 feet deep.

The mesoscale approach to greater understanding of subsurface contamination is more than just an

acknowledgement of the subsurface's complexity, it is a necessary step forward for geoscience. Through this type of research, scientists can build on what they have learned in small-scale bench work and test their ideas in controlled, nearly field-scale environments.

"The SGL will primarily be used to study the coupling among hydrological, geochemical, and microbiological processes," said Phillip Michael Wright, director of the INEEL's Subsurface Science Initiative, "and then to incorporate new understanding into more reliable predictive computer simulation models of the fate and transport of contaminants in the earth's subsurface."

The vast array of information needed to make predictive models more accurate can be more easily acquired through the mesoscale research conducted at the SGL.

The benefit of this type of research is new solutions will be produced for environmental remediation. "Improved scientific understanding will also result in the development of new geophysical techniques and sensors for characterizing the subsurface," Wright said. "As a result of developing more effective approaches for environmental remediation, we can develop novel instrumentation for monitoring the long-term effects of these remediation techniques."

human component. Because the SGL is intended to be a multidisciplinary user facility, the team must design a facility that creates highly sophisticated environments for equipment, and also a human environment conducive to productive, interactive research. The design must promote intellectual exchange, stimulating collaborative research among researchers from INEEL, universities, and institutions from around the world.

Because of the large equipment sizes needed for mesoscale research, the facility design will be more complicated than designing a traditional laboratory space. Scientists need massive tanks and equipment, high-bay spaces, and a bridge crane to handle the bulk rock, sand, and soil both before and after the experiments. Specialized design is also required to isolate the facility's unique equipment from vibrations and external electromagnetic interference. The use, storage, and safe disposal of hazardous chemicals—a critical component of conducting research relevant to DOE's environmental management mission—must also be accommodated.

Using "Green Building" Principles

From the outset of the design, ZGF will actively incorporate "green building" principles. These are environmentally responsible approaches to the building process, which include building site and material selection, energy efficiency, use of renewable resources, and recycling.

ZGF has received several awards for energy-conscious, environmentally-sensitive building design, including the 2000 Leadership in Energy and Environmental Design Certification from the U.S. Green Building Council for the University of California Santa Barbara, Donald Bren School of Environmental Science and Management. ZGF is particularly noted for the award-winning William R. Wiley Environmental Molecular Sciences Laboratory at the Pacific Northwest National Laboratory.

ZGF is headquartered in Portland, Oregon, and has offices in Seattle, Los Angeles, and Washington, DC.

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Center for Science and Technology is Launched

A new facility for collaborative subsurface science research—the 50,000 square foot Center for Science and Technology (CST)—will soon become a reality. On August 29th, 2001 a public ceremony was held to launch the CST and celebrate the collaboration of Idaho's "partners in progress." The celebration included remarks by Idaho Gov. Dirk Kempthorne, U.S. Sen. Mike Crapo, Idaho Falls Mayor Linda Milam, University of Idaho President Bob Hoover, Idaho State University President Richard Bowen, INEEL President and General Manager Dr. Bill Shipp and others.

A Building and a Partnership

The University of Idaho (UI) will own the building and is the project manager, but is part of an expanded team that also includes Idaho State University (ISU), the INEEL, the seven-university Inland Northwest Research Association (see article on page 4), industry and government.

Groundwork is anticipated in the fall, construction contracts will be secured by spring 2002, and building completion is targeted for 2003. The estimated cost is \$11 million to provide state-of-the-art labs and learning space that initially will house more than 100 professionals and graduate students. The two universities will conduct some graduate and research programs there, INEEL scientists will occupy half of the building, and industry and science tenants will lease other space.

(CST Launch, continued on page 6)



U.S. Sen. Mike Crapo addresses the CST Project Launching celebration audience (above). Idaho Governor Dirk Kempthorne discusses the CST with INEEL President and General Manager Dr. Bill Shipp and University of Idaho President Dr. Robert Hoover (below, from left to right).



*Dr. Gautam Pillay,
INRA Executive Director*

INRA is a group of seven research universities from Idaho, Montana, Utah, and Washington, created to facilitate research and national partnerships between the member institutions and the private sector, federal agencies, and federal laboratories. The intent of the partnership is to stimulate both the academic and economic development of the Inland Northwest.

According to Dr. Gautam Pillay, INRA Executive Director, "Together, the INRA universities' total research dollars, student populations, and funding capabilities are similar to those of the largest research university systems in the country. It is just dispersed over a broader regional area."

INRA intends to assist in building a sustainable work force for the INEEL by attracting and retaining top research talent, fostering career growth, and building continuity in knowledge.

Shortly after its formation, INRA successfully partnered with Bechtel National, Inc. and BWX Technologies, Inc. to form a new organization, Bechtel BWXT Idaho, LLC, which was awarded the DOE contract for

management and operation of the INEEL. As a business partner, INRA works closely with the INEEL's staff to build collaborative research programs involving INEEL scientists and INRA research faculty, students, and post-graduate researchers. The organization has also developed a post-doctoral program in collaboration with the INEEL's Education and Research Initiatives Division.

Developing and Strengthening Subsurface Science Research

Today, top research faculty from INRA institutions are working closely with scientists from the INEEL to build a world-class subsurface science research program. "Together these institutions have a variety of unique resources," said Pillay. "The types of subsurface research taking place at

INRA universities builds on the strengths of each partner university. Some of the research capabilities and facilities provided by INRA are comparable to those of a national lab, but academic researchers also benefit from the specialized facilities only afforded by national laboratories."

Both INRA and the INEEL are strengthened by their relationship. INRA researchers and facilities are being tapped by the DOE to gain the improved understanding DOE needs to solve issues critical to its cleanup mission. Work with the INEEL gives INRA institutions the opportunity to use the Subsurface Science Initiative's facilities. This will include the research capabilities offered by the proposed Subsurface Geosciences Laboratory, which will house a mesoscale geocentrifuge, massive aboveground soil tanks and other mesoscale equipment.

"Our researchers are all very excited about having access to these resources because these are unique facilities that are otherwise unavailable," Pillay said.

"The partnership is very beneficial for INEEL too," Pillay pointed out. "Gone are the days when a national lab can stand by itself. DOE's non-weapons labs, especially, need to demonstrate that they are capable of working with industry, other national labs, and academic institutions. Having a formal partnership between the INEEL and INRA makes sense for a national lab."

INRA's mission is to:

- ***Establish, develop and strengthen multidisciplinary research and educational programs of interest and benefit to the Inland Northwest,***
- ***Collaborate with business and government agencies to develop and strengthen such programs at INRA member institutions, and***
- ***Utilize its resources in such a way as to maximize the performance of its partners, whether they are other educational institutions, business enterprises, or government agencies.***

INRA Funded Subsurface Science Research

The main change resulting from the INRA/INEEL partnership is an increased ability and interest in sending students and faculty to the INEEL to participate in collaborative research. "Our universities are able to realize greater opportunities now that INRA and this partnership exist," Pillay said. "Operating a national laboratory obviously provides broader direct funding opportunities for students and post-docs, but more importantly, other funding agencies tend to be more favorably inclined toward multidisciplinary, multi-institutional, large-scale research programs."

One of the ways research is funded is by contractual obligation, in which INRA and its corporate business partners invest a portion of the management fee associated with running the INEEL back into research. This is handled through the Corporate Funded Research and Development (CFRD) program. Together, INRA's Board of Trustees and CFRD determine a research focus, which results in a call for proposals.

INRA chose subsurface science for the FY 2001-2002 area of research emphasis, providing \$3 million in funding for INRA's nineteen multi-year projects. "Peer-reviewed proposals were competitively awarded to member institutions. Like any competitive situation, only the very best proposals get funded," Pillay said.

"Operating a national laboratory obviously provides broader direct funding opportunities for students and post-docs, but more importantly . . .

. . . funding agencies tend to be more favorably inclined toward multidisciplinary, multi-institutional, large-scale research programs."

The 1st Annual Subsurface Science Symposium was held in early September (see article on page 6). Co-sponsored by INRA and INEEL, it was the first opportunity to share the initial results of INRA's subsurface research. "It was an opportunity for the INRA and INEEL researchers working on these projects, and for researchers working in other areas of subsurface science to come together and learn what's going on," Pillay said.

INRA Corporate Funded Research Requirements

"INRA's formal call for proposals," Pillay said, "is distributed just like any other, with a due date, guidelines, and points of contact at each institution and the INEEL. A peer-review committee reviews the proposals and determines which will be funded."

Each proposal requires a minimum of three people to be involved: an INRA researcher, a project representative from the INEEL, and a Ph.D. student or post-doctoral researcher. Interactions between team members, including site exchanges, must occur through the life of the proposal. Researchers must be able to summarize the scientific and technical information for peer-reviewed publications.

"The INEEL must continue to demonstrate to the academic and research community that their research is scientifically acceptable," Pillay said. "Ultimately, our CFRD investments are seed money to initiate research.

(INRA, continued on next page)

A PhD in Subsurface Science!

Each of the INRA universities has a unique capability to support the different facets of subsurface science. INRA member institutions are discussing combining these capabilities to establish a joint subsurface science Ph.D. program where courses are shared and delivered to all INRA institutions and to the University Place campus in Idaho Falls. Students would be able to participate in courses from all seven institutions instead of being limited to single-institution courses.

"For example, a student would be able to do research at the INEEL and any other of the INRA institutions, put all the research and course work from the various universities together, and get a degree from the university of their choice," said Pillay. The main component of this proposal is developing new subsurface science courses and putting them together to form a cohesive course program outline.

Until now, this hasn't been done in subsurface science. "Right now you can get a formal Ph.D. in Civil or Environmental Engineering from a single university," Pillay explained, "but, to give an example, we envision students being able to tap into the bio-capabilities of Montana State or the water resource management capabilities at Utah State or the University of Idaho—doing that as seamlessly as possible and in the end earning a multidisciplinary Ph.D."

"The idea is to educate the existing INEEL workforce and the next generation workforce. This proposal is a high priority for INRA and has the full support of INEEL management, but it is a massive undertaking that will require significant resources and support." Steps have already been taken, such as remote course delivery and sharing course credit among university partners.

(INRA, continued from prior page)

After two or three years of internally-sponsored funding, researchers need to have enough data and conclusions to send proposals to the DOE, Department of Defense, National Science Foundation, or other agencies."

INRA's Role Beyond INEEL

In time, INRA seeks to expand and engage in interactions with other national laboratories, other institutions in the government, and with private industry—applying its experience with the INEEL to these other institutions. "One of my jobs as the first permanent Executive Director of this organization," Pillay said, "is to help INRA become an entity in and of itself, moving forward, and building ties to the INEEL and other regional institutions. There are other DOE and DoD institutions located in or very near INRA states that are similar to the INEEL both in their missions and environmental management issues. INRA's successes at INEEL can definitely be exported and I see that as part of INRA's future."

For more information about the Inland Northwest Research Alliance (INRA), visit their website at <http://www.inra.org/>.

**Keynote Speaker
Dr. Edgar Berkey
speaks with INRA
Executive Director
Dr. Gautam Pillay at
the 1st Annual
Subsurface Science
Symposium**



1st Annual Subsurface Science Symposium

More than 130 attendees gathered for the 1st Annual Subsurface Science Symposium held September 6 and 7, 2001 in Idaho Falls, Idaho.

"The main purpose of the symposium, which was co-sponsored by INRA and the INEEL, was to bring together INRA and INEEL Principal Investigators who are INRA research grant holders to talk about their research," said Dr. Gautam Pillay, INRA's Executive Director. One of INRA's primary goals is to organize collaborative research projects at INRA universities and the INEEL into a cohesive program that achieves national and international recognition in subsurface science. Annual symposiums are vital to achieving this.

The symposium was also a forum for students to learn about current

research. "The poster competition with cash awards proved to be an excellent way for the students to share information on their own projects," Pillay said.

In addition to the student poster session, other events included the featured keynote address, given by Dr. Edgar Berkey of Concurrent Technologies Corporation, plenary sessions presenting INRA and INEEL programs, and technical presentations and poster sessions.

The results of the symposium, papers from the symposium and winners of the poster contest are available on the INRA website at <http://www.inra.org>. Each INRA member university also has a list of poster contest winners.

(CST Launch, continued from page 3)

A Place for Subsurface Research

The preliminary designs for the 50,000-square-foot facility, created by the Seattle architectural firm NBBJ, show joint "laboratory suites" for clustering common research. Professors and students from ISU, UI and the other INRA institutions will work alongside scientists from INEEL. Research will be conducted in geology, hydrology, geochemistry, geophysics, bioremediation, modeling and more.

The Center will have standard and flexible facilities including: wet and dry laboratories; high-bay facilities; electronic laboratories; teaching laboratories; and offices for faculty, researchers, and graduate students. Compressed video conferencing facilities, conference rooms and several classrooms are also planned. The Center also will have offices

for visiting faculty, students, and post-docs, offering visiting scientists the freedom to do their research outside the INEEL's security firewall. Potential student housing, to be located nearby, is already being considered.

The Center is currently under construction in Idaho Falls, Idaho on 19 acres of riverfront property north of the current University Place campus. It will be located near the INEEL's Willow Creek and Engineering Research Office Buildings.

The INEEL is also on track to build a partner research laboratory facility (see cover story). This additional facility, the Subsurface Geosciences Laboratory, is proposed for completion by 2007. The plans for the construction of both research facilities have been a cooperative effort between city, state, and federal governments; INRA; and the INEEL.

Unsaturated Zone Interest Group (UZIG) Conducts Annual Get-Together

More than 130 people participated in the Unsaturated Zone Interest Group (UZIG) a month ago in Idaho Falls, Idaho. Representing the U.S. Geological Survey (USGS), DOE, universities, and other institutions, they met to discuss a variety of topics, including ground-water contamination, aquifer recharge, and the management of land affected by waste disposal, agriculture, and mining.

The informal UZIG was originally a small, close-knit group of vadose zone researchers, formed a decade ago by the USGS to encourage and support inter-disciplinary collaboration and provide a forum for scientific discussion and

networking

"It's really crucial for researchers to meet on a peer-to-peer basis ...

... you have the opportunity to connect with people doing related work, and more importantly, establish relationships that lead to joint research projects."

Earl Mattson, a hydrologist at INEEL and co-organizer of this year's conference, said one of the most important reasons he attends UZIG meetings is to meet people and find individuals interested in pursuing collaborative research. The conference provides opportunities for dialogue with a diverse group of peers on works in progress. "It's really crucial for researchers to meet on a peer-to-peer basis," Mattson said. "Not only can you discuss the state of the science and your own research, you have the opportunity to connect with people doing related work, and more importantly, establish relationships that lead to joint research projects."

At the recent meeting, co-sponsored by DOE, the INEEL, and the University of Idaho, there were nearly 80 technical presentations of research findings and future needs.

Today, cooperative studies among USGS, national laboratories, and university researchers are becoming more common and UZIG has continued to grow. Programs such as DOE's complex-wide road-mapping, the National Science Foundation's Science & Technology Center on Sustainability of Water Resources in Semiarid Regions, and the INEEL's Subsurface Science Initiative have supported and stimulated further interest in the vadose zone.

Keynote speaker Dr. John Wilson addresses the UZIG group. UZIG participants discuss poster topics and tour INEEL research facilities (clockwise from top).



Most of the issues related to contaminant transport, though issues concerning regulatory and policy issues and DOE's vadose zone efforts were also addressed. The topics included:

- Flow in Fractured Media
 - Gas-Liquid-Solute Interactions
 - Transport of Solutes and Particles
 - Deep Percolation and Recharge
- Subsurface Measurement and Physical Modeling
- Modeling Techniques
- Modeling of Specific Sites
- Linkages With Theory, Applications, and Policy
- Preferential Flow Observations and Interpretations
- Techniques for Determining Hydrologic Properties

UZIG's keynote speaker was John Wilson of the New Mexico Institute of Mining and Technology. He presented a lively dinner discussion on "The Future of Unsaturated Zone Hydrology." The get-together was then capped with an all-day field trip to interesting vadose zone sites at the INEEL.

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UZIG website: <http://mn.water.usgs.gov/uzig/>

Job postings for the Subsurface Science Initiative are on the Internet at <http://jobs.inel.gov/>

Qualified candidates are invited to send their CV with a cover letter detailing their scientific, administrative and leadership qualifications to:

**Subsurface Science Initiative
Research Search Committee
c/o Russel Hertzog
Idaho National Engineering
and Environmental
Laboratory
P.O. Box 1625
Idaho Falls, ID
83415-2203**

INEEL to Procure Centrifuge for Geotechnical Studies

The INEEL is purchasing a model C-61 geotechnical centrifuge system (50-g tons, 2-m radius) from Actidyn Systemes (<http://www.actidyn.fr/>) with installation expected in early December 2001. The geotechnical centrifuge laboratory will be used to investigate subsurface movement of fluids and contaminants, and long-term performance of engineered caps and barriers used for subsurface waste disposal or stabilization.



Three Winners Surface in Subsurface Science Symposium Poster Competition

A number of students from the INRA universities competed in the 1st Annual Subsurface Science Symposium technical poster contest. The competition ended in a three-way tie for first place. The winning entries were:

- "Impact of Microbial Biofilms on Fluid Flow through Fractured Rock Systems," Catherine Reardon, Idaho State University
- "Biofilm-induced Changes in Soil Organic Matter Structure and the Resulting Impact on the Bioavailability of Sorbed 2,4,6-Trinitrobenzene and its Amine Metabolites," Thomas Borch, Montana State University
- "Developing Methods to Study the Partitioning of Plutonium to INEEL Soils and Sediments," Hiromu Kurosaki, Washington State University.

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